downward in the latter, and the stem bears many small, crippled leaves. Nematodes were found to be the cause of the trouble. Recently the same disease has again appeared near Alexandria. Microscopic examinations showed that the nematodes were more abundant in the secondary roots than in the main ones. The secondary roots are destroyed, the food supply is thus cut off and the growth is checked in consequence. The matter is complicated by the presence of other species of nematodes. "Trap-crops" are suggested for the removal of most of the nematodes. This it is argued will remove so many that they will not be especially injurious. No other definite remedy is given.—P. SPAULDING.

NOTES FOR STUDENTS.

P. J. O'GARA,[4] of the University of Nebraska, has conducted experiments which indicate that *Sphaeropsis rhoina* of the sumac and *S. malorum* of the apple are the same fungus. At least, the former will cause black rot in the fruit of the apple, and will also produce the typical "canker" on the branches just as readily as the latter.—J. M. C.

MRS. E. G. BRITTON and Miss A. Taylor[5] have published an account of the morphology and anatomy of *Vittaria lineata*. The prothallium is irregularly branched and consists of a single plate of cells. It has remarkable powers of vegetative propagation and produces gemmae very similar to those described by Goebel for *V. elongata*. The antheridia are very numerous, and are produced either upon the ventral surface of the prothallium or upon the gemmae, and rarely upon the same prothallium as the archegonia. The development of the antheridium is of the usual polypod type, with funnelform wall and cap cell, and twelve or twenty-four sperms are produced. The long stalk of the sporangium seems to be formed chiefly by a single row of three or more elongated cells, longitudinal divisions occurring next to the spore-case. The interesting observation is made that the small stalk-cells at the base of the spore-case become very much inflated, and when the case opens they tilt it back. Long-stalked, branching, and multicellular paraphyses occur among the sporangia, the terminal cells being elongated, curved, and enlarged at apex.—J. M. C.

ITEMS OF TAXONOMIC INTEREST are as follows: SPENCER LEM. MOORE (Jour. Bot. **40**: 305. *pl. 441*. 1902) has described a new African genus (*Amphoranthus*) of Caesalpineae from Damaraland.—E. L. GREENE (Pittonia 5: 1–56. 1902) has published 6 new species of Acer, 22 new species of Microseris, 14 new species of Phacelia, 7 new segregates of *Viola canadensis*, 8 new acaulescent violets, a revision of Romanzoffia (10 species, 8 of which are

[4] Science **15**: 434–435. 1902.

[5] The life history of *Vittaria lineata*. Memoirs Torr. Bot. Club **8**: 185–211. *pls. 23–31*. 1902.

new), a revision of Capnorea (14 species, 8 of which are new), 5 new species of Cryptanthe, and 3 new species of Compositae (Helenium, Thelesperma, Vernonia).—C. DECANDOLLE (Urban's *Symbolae Antillanae* 3²: 159–274. 1902) in his monograph of West Indian Piperaceae recognizes 70 species in Piper (21 new), 3 in Verhuellia, 79 in Peperomia (4 new), and excludes *Symbryon* Griseb.—JANET PERKINS (Engler's Bot. Jahrb. 31: 481–494. 1902) has completed her study of Styracaceae and has revised the genus Lisianthus (Gentianaceae).—ALICE EASTWOOD (Bull. Torr. Bot. Club 29: 523–525. 1902) has described new western species of Castilleia, Lappula, Corydalis, and Campanula (2).—H. D. DEBOISSIEU (Bull. Herb. Boiss. II. 2: 803. 1902) has described a new genus (*Melanosciadum*) of Umbelliferae from China, belonging to the Smyrnieae.—J. M. C.

PROFESSOR STRASBURGER, in his first paper[6] on double fertilization, insisted that in fertilization two processes should be recognized: the stimulation to development and the mingling of ancestral qualities, the latter process being the essential one, and the stimulation to development only providing the conditions which make it possible to attain the advantages which result from a mingling of ancestral plasma masses. In a recent paper[7] he defines very clearly his own views and makes critical references to recent work. Fluctuating variations do not furnish a starting point for the formation of new species. It is the principal function of fertilization, through the mingling of ancestral plasma masses, to keep the species characters constant. This view agrees with that of Richard Hertwig and approaches that of Solms-Laubach in so far as the latter regards "so-called fertilization," or the fusion of hereditary masses, as an essential element in fertilization; but Solms-Laubach regards the stimulation to development as an equally important attribute of fertilization. Strasburger, however, defines the "so-called fertilization" definitely as the union of the two hereditary plasma masses and believes that it was to insure this essentially "generative fertilization" that in the course of phylogenetic development the inability of the sexual cells to develop indepeudently without fusion became more and more marked. The term "generative fertilization" is used to designate a union of ancestral plasmas, in contrast with "vegetative fertilization," which is merely a stimulus to development. Were it not for the fact that the two processes occur simultaneously, the distinction would have been recognized long ago. The term "fertilization" has often been loosely used in cases like many nuclear fusions in fungi, where there is no union of hereditary masses, but only a stimulus to development. While Strasburger would be willing to admit that the stimulus to development might be due to chemical or physical influences, he insists that "generative fertili-

[6] STRASBURGER, ED., Einige Bemerkungen zur Frage nach der doppelten Befruchtung bei den Angiospermen. Bot. Zeit. 58: 293–316. 1900.

[7] STRASBURGER, ED., Ueber Befruchtung. Bot. Zeit. 59: 1–8. 1901.

zation" is not a purely chemical process. Winkler suggests that bastards might be produced by chemical fertilization. Strasburger regards this as impossible and believes that the essence of fertilization lies in the union of organized elements. The view that the epigenesis of form is only an expression of the epigenesis of chemical power might, perhaps, appeal more to the physiologist than to the morphologist who has studied more deeply the developmental history of organisms. No doubt morphologists busied themselves too long with a one-sided mechanical view of ontogeny. If the chemical theory does not in the same way go beyond the mark, the two views united should be useful in extending our knowledge.—C. J. CHAMBERLAIN.

IN a rather extended paper Van Tieghem[8] indicates his ideas of taxonomy as developed in the light particularly of researches upon ovular anatomy and morphology. For some time systematists have been familiar with the revolutionary attitude of the dean of French botanists, and his long successions of new families of plants have been duly noted in the bibliographies, but have not produced any general modification, either in Germany or America, of the current taxonomic sequences. Indeed, it would be a somewhat serious matter if it became necessary to rearrange herbaria upon the Van Tieghem system, since it is a complete *bouleversement* of the Engler-Prantl order, which has recently pretty generally superseded the old Benthamian arrangement of the families.

The object of M. Van Tieghem is apparently to develop a new classification founded upon the methods of reproduction in plants; how successful he has been must be left to the consensus of botanists to determine. The reviewer, after a careful examination, finds himself unable to follow Van Tieghem either in the general plan of his system or in the detail of its elaboration. To go over the points one by one would be impossible in a brief review, and I shall select but a couple of examples for criticism, believing that they will illustrate the system as a whole.

Van Tieghem begins by dividing the plant kingdom into two subkingdoms which he calls *Diodeés* or Prothalleés and *Adiodeés* or Aprothalleés. One finds that in the Adiodeés, which is the lower group, types from Protococcus to Polytrichum are included. Here too are such forms as Vaucheria and Fucus. In the Diodeés are the ferns and flowering plants. The distinction between the two subkingdoms according to Van Tieghem is the production of the eggs directly upon the "plant-body"—*naissance directement sur le corps adulte*—in the Adiodeés, and upon a special rudimentary body—the prothallium—in the Diodeés. Van Tieghem characterizes the former as "direct" formation of the egg and the latter as "indirect." Such a classification ignores the homologies established by Hofmeister and accepted

[8] VAN TIEGHEM, PH., L'oeuf des plantes, considéré comme base de leur classification. Ann. Sci. Nat. Bot. VIII. 14: 213–390. 1901.

universally since his time. It is at variance with modern ideas of alternation of generations and its significance. It fails to preserve the unity of the archegoniate series, but breaks it in two in the middle, separating closely related forms and throwing Anthoceros into one subkingdom and Phylloglossum into another. This is distinctly reactionary and opposed to the great current of embryological research from Von Mohl to Bower. The further subdivision by Van Tieghem of his Diodeés into *Exoprothalleés* and *Endoprothalleés* is equally artificial and objectionable.

Turning now to a matter of detail. Van Tieghem places at the bottom of his class Homodiodeés the *Inovuleés*, characterized by the absence of ovules. That brings the Loranthaceae practically to the bottom of the dicotyledons, a most improbable position for a group of metaspermic parasites. Reduction in such plants might be expected in connection with the high ecological specialization, but rudimentary structure would be altogether astonishing in the family to which the mistletoe belongs. It is rather in the aquatic medium that one would expect the primitive dicotyledons, and, indeed, in such plants as Nelumbo, investigated by Lyon, and Ceratophyllum, studied recently by Strasburger, the transition from the monocotyledonous to the dicotyledonous habit can be seen. No system that confuses reduced structures such as the placentation and ovule of the Loranthaceae with genuine rudimentary and simple structures can command wide adherence.

From top to bottom, both in the general and in the special portions, the Van Tieghem classification seems to be an inversion of the truth. Nevertheless, it is a distinctly ingenious and stimulating piece of work, and has already more than justified the labor spent upon it by its venerable and distinguished author, in the light it has thrown upon some of the smaller and more obscure groups of dicotyledonous plants. That it will be generally accepted is improbable, and it seems doubtful whether it will gain much currency even in France. The students of systematic botany, however, will be fully repaid by reading it, for it is both brilliant and interesting.—CONWAY MACMILLAN.

NEARLY FIFTY YEARS AGO there was described a species of Dischidia with remarkable double pitchers. Pearson[9] now makes an examination of the phenomenon. He finds double pitchers in four species of the genus: *D. complex* Griffith, Malacca; *D. pectenoides* Pearson, n. sp., Philippines; *Dischidia* sp., Borneo; *Dischidia* sp., Borneo; the last two are undescribed, and in very imperfect condition. The pitchers in these species, as in the other pitcher-producing species of the genus, of which by no means all show this characteristic, are morphologically leaves, the inner surface of the pitcher being homologous with the under surface of the foliage leaf. The origin of

[9] PEARSON, H. H. W. On some species of Dischidia with double pitchers. Jour. Linn. Soc. **35**: 375–390. *pl. 9.* 1902.

the simple type of pitcher seems to result from an early arrest of apical growth and a rapid growth of the central portion of the morphologically upper surface with a consequent bulging out. In the double pitchers, the structure of which is described in detail, the inner pitcher may be supposed to have been formed first, since in the development of the pitchers of *D. Rafflesiana* apical and basal growth in the leaf ceases at an early stage, and the pitcher has assumed a definite form, so that in species with the double pitchers a resumption of apical growth, with the accompanying involution which gives rise to the inner pitcher, can hardly be supposed. As to the function of the pitchers, conclusions based on herbarium material must necessarily be unsatisfactory. Fairly complete investigations have quite conclusively shown that the pitchers of *D. Rafflesiana* are to be regarded as living "flowerpots," containing, as they usually do, water and soil and being supplied with a copious root system. In the four species under consideration, all of which are epiphytes, and clearly xerophytic in structure, the author was able to examine the contents of nine pitchers, all of which contained roots, and in all cases more or less soil in the outer but none in the inner pitchers. It seems, as Groom believes to be the case in *D. Rafflesiana*, that the greater the amount of soil the greater the development of roots in the outer pitcher. That ants bring the soil into the pitchers of these species the author of the paper considers certain, the ants making their nests in the pitchers. To what extent the plant depends upon the food material contained in these organs is unknown, but the indications are that they are of no inconsiderable importance. As to the benefit derived by the ants from this symbiotic relation, the pitchers are convenient shelters and nesting places, for which the four species may be assumed to be better adapted than *D. Rafflesiana*, on account of the narrower entrances and more commodious forms. As to the function of the inner pitcher, they may possibly serve as a place of refuge for the ants in case of danger from drowning. There is some indication, in *D. pectenoides* at least, of a possible function as a feeding ground, the food material being a sweetish substance, evidently a decomposition product. Examination of the inner wall of the outer pitcher reveals the presence of a dense weft of superficial mycelium, the explanation of the presence of which was impossible. A similarity to forms described by Muller in the "fungus gardens" of some South American ants was noticed. Dischidia, then, shows a series of modified leaves more remarkable perhaps than any other known genus, the highest specialization of which is found in the four species here described, where the adaptation to the residence of ant colonies as well as the economy of water seems to have reached its highest point.—J. ARTHUR HARRIS.

EDGAR W. OLIVE [10] has published a detailed account of the Acrasieae,

[10] Monograph of the Acrasieae. Proc. Boston Soc. Nat. Hist. **30**: 451–513. *pls. 5–8.* 1902.

whose problematical relationship to the Myxomycetes has been the subject of considerable discussion. The two groups of Acrasieae (Guttulinaceae and Dictyosteliaceae) agree in that the vegetative individuals assume the form of amoeboid cells which never pass through a swarm cell condition, and in that the individuals during the fructifying period unite to form colonies (pseudoplasmodia); but they differ widely in the general character and structure of their fructifications, the Guttulinaceae showing little or no differentiation, and the Dictyosteliaceae considerable differentiation both in structure and function. In certain forms two types of division were observed; one in the young individuals shortly after germination, occupying a number of hours and accompanied by prolonged nuclear changes that resemble karyokinetic division; the other during the subsequent active amoeboid condition, resembling direct division and taking place usually within a few minutes. In a discussion of the sytematic relations of the Acrasieae, the author states that there can be no question as to the common origin of the Myxomycetes and the Acrasieae, but that when the two groups are carefully compared it appears unlikely that the former have been derived directly from the latter, since the amoeboid stage is in reality the only feature strictly comparable. The families and genera recognized are as follows: Sappiniaceae: *Sappinia* Dangeard (1 sp.); Guttulinaceae: *Guttulinopsis* Olive (3 spp.), *Guttulina* Cienkowsky (4 spp.); Dictyosteliaceae: *Acrasis* Van Tieghem (1 sp.), *Dictyostelium* Brefeld (7 spp.), *Polysphondylium* Brefeld (3 spp.), *Coenonia* Van Tieghem (1 sp.). —J. M. C.

ONE OF DR. ENGLER'S latest conceptions, which is already beginning to find concrete realization, is a vast botanical garden, which shall display the characteristic plant formations of the world. The underlying idea in Dr. Engler's scheme is floristic rather than ecological, although typical edaphic plant societies find representation. He had already outlined in detail his plan for an alpine garden — this has received very favorable mention, and may be referred to somewhat fully in these pages at another time. In a pamphlet[11] of nearly a hundred pages Dr. Engler gives a plan of the garden and states his ideas in full as to the floristic subdivision of North America north of Mexico. The four chief divisions are *Arctic*, *Subarctic*, *Atlantic*, and *Pacific*. The Arctic division is like that of Europe and is not treated. Subarctic North America is subdivided into eastern, central, and western districts (Bezirke). Atlantic North America is subdivided into four provinces; lake, Mississippi and Alleghany deciduous forest, south Atlantic evergreen, and prairie. Pacific

[11] ENGLER, DR. ADOLF, Die pflanzengeographische Gliederung Nordamerikas erläutert an der nordamerikanischen Anlage des neuen Königlichen botanischen Gartens zu Dahlem-Steglitz bei Berlin. Separate reprint from Notizblatt Königl. Bot. Gart., Appendix IX. 8vo. pp. iv + 94, with plan and distribution map. Leipzig: Wilhelm Englemann. 1902. *M* 2.40.

North America is subdivided into three provinces: Pacific conifer, Rocky mountain, southwestern arid or semi-arid. All of these areas are further subdivided and characteristic formations and species are given in some detail. Occasionally there are errors to be found in the alignment of species, as might be expected in a paper which is largely a compilation from the works of Sargent, Brendel, Mohr, Kurtz, Pound and Clements, and others. However, the broad outlines of the work are remarkably true to the facts. It is particularly interesting to see Atlantic and Pacific America separated into primary divisions, recognizing that the great cleavage lines in the United States run north and south. Ecologists have always known that the plant formations of this country had such an orientation, but many students of floristics during the last decade have attempted to make their great cleavage lines run east and west. We may hardly regard the question as settled, but rather opened up for further study. The details in Engler's paper are remarkably true in most instances; indeed one is obliged to confess that it is the best floristic presentation of the vegetation of this country which has yet appeared. Though designed to indicate the plan of a botanical garden in Germany, it is nevertheless so important a contribution to American phytogeography as to be a necessary work of reference.— H. C. COWLES.

R. H. YAPP[12] has recently treated of the anatomy, biology, and systematic position of *Polyodium* (*Lecanopteris*) *carnosum* and *Polypodium sinuosum*. As to systematic position, he concludes that while that of *P. carnosum* has been a debatable one, both of the forms should be regarded as closely allied species, both from external features and internal structure. Both are Malayan epiphytes. *P. carnosum* grows only in the higher branches of trees and usually on fairly high mountains, where it forms thick encrusting masses often several feet in length; while *P. sinuosum*, whose creeping rhizomes not forming such thick masses as those of *P. carnosum* are frequently seen quite near the ground, and usually on the trunk itself or on the main branches of its host, is often found almost at sea level. The distribution of *P. sinuosum* is more extended than that of *P. carnosum*. The thick fleshy rhizomes of these epiphytes are tunneled by a system of galleries similar to those of *Myrmecodia* and *Hydnophytum*, and like them invariably inhabited by ants. The origin of the galleries is similar in the two species. About 1–2^{mm} from the growing point and after the differentiation of procambium and protoderm, the parenchymatous cells in certain definite areas undergo a more rapid increase in size than those of the remaining ground tissue, the difference in size becoming more marked farther back from the apex. These zones of tissue, whose cells have increased so remarkably in size with little or no division, are sur-

[12] Two Malayan myrmecophilous ferns, *Polypodium* (*Lecanopteris*) *carnosum* (Blume), and *Polypodium sinuosum* Wall. Ann. Botany **16**: 185–231. *pls. 10–12.* 1902.

rounded by a zone several layers deep of relatively small brown cells, which has been developed by radial and longitudinal division during the increase in size of the cells of the included tissue. At a distance of 2^{cm} from the apex, the large cells, which have been filled chiefly with water, the walls having merely a film of protoplasm, break down, giving rise to the ant galleries, which are thus of lysigenous origin. The arrangement of the galleries is in both cases regular, although not exactly the same, a main ventral longitudinal gallery giving off two lateral series of galleries to the branches and two vertical series leading to the leaf-cushions, branching soon after leaving the ventral gallery to form two longitudinal series of dorsal chambers. Communication with the external air is secured by short passages excavated in the soft tissue of the younger parts of the stem by the ants themselves. While the function of the galleries is still somewhat obscure, the large-celled tissue seems to have been developed as a special water-reservoir, but its early disintegration may indicate an important function in the galleries, as aeration or to a slight extent absorption of water. There is no evidence that the galleries are an adaptation on behalf of the ants. In *P. carnosum* the marginal lobes upon which the sori are borne are reflexed at maturity so that they are turned upward, this being possibly an adaptation to secure the distribution of the spores during a strong wind, which would be most favorable for a high growing epiphyte.—J. ARTHUR HARRIS.